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Citation for published version:

Rohde, H & Kehler, A 2008, "Demanding an Explanation: Implicit Causality Biases in Discourse Interpretation", CUNY 2008, South Carolina, United States, 13/03/08 - 15/03/08.
<<http://www.unc.edu/cuny08/CUNY2008%20Posters%20in%20Order%20by%20Session.pdf>>

Link:

[Link to publication record in Edinburgh Research Explorer](#)

Document Version:

Peer reviewed version

Publisher Rights Statement:

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Demanding an Explanation: Implicit Causality Biases in Discourse Interpretation

Hannah Rohde & Andrew Kehler

Abstract

Problem: Previous passage-completion studies report strong biases regarding who will be mentioned next following implicit causality (IC) verbs with a 'because' prompt. However, these biases are reduced/eliminated with a full-stop prompt.

- (1) a. John scolded Mary because _____. [strong bias to Mary]
b. John scolded Mary. _____. [mixed biases]

Proposal: In light of recent results showing two types of coherence-driven expectations in pronoun interpretation, we compare responses to contexts like (1a-b). We predict that IC biases depend both on expectations about upcoming continuation types ($P(\text{coherence})$) and on biases for which event participant will be mentioned again conditioned on continuation type ($P(\text{referent} | \text{coherence})$).

Results: By categorizing responses by coherence relation, we localize the previously reported IC bias to Explanation relations. We find an additional IC bias concerning $P(\text{Explanation})$. This bias has gone unnoticed because previous work has not categorized responses by coherence.

1. Goal

To clarify the effects of IC biases on discourse interpretation by distinguishing (i) next mention biases and (ii) biases toward upcoming coherence relations.

2. Previous work on Implicit Causality

Passage completions: strong IC bias to particular referent with 'because' prompt (Caramazza, Grober, Garvey, Yates 1974; McKoon, Greene, Ratcliff 1993; *inter alia*)

- (1) a. IC-1 John annoyed Mary because _____. [bias to NP1 John]
b. IC-2 John scolded Mary because _____. [bias to NP2 Mary]
c. Non-IC John babysat Mary because _____. [mixed biases]

However, next-mention bias reduced/eliminated with full stop prompt (Au 1986, *inter alia*)

- (2) a. IC-1 John annoyed Mary. _____.
b. IC-2 John scolded Mary. _____.
c. Non-IC John babysat Mary. _____. [mixed biases]

What is role of 'because'?

- Modifying salience of event participants directly (Stevenson, Knott, Oberlander, & McDonald 2000)
- Signaling an Explanation coherence relation (Hobbs 1979, Kehler 2002)

3. Using coherence to model next-mention biases

We generalize Rohde, Kehler, & Elman's (2007) pronoun model to next mention: Biases towards upcoming coherence relations (CRs) combine with biases for which event participant will be mentioned again, conditioned on coherence

$$(3) P(\text{next_mention} = \text{referent}) = \sum_{CR \in CRs} P(CR) * P(\text{next_mention} = \text{referent} | CR)$$

- $P(CR=\text{Explanation}) = 1$ with 'because', but $P(CR=\text{Explanation}) < 1$ in full stop
→ Next-mention bias, $P(\text{next_mention} | \text{Explanation})$, is predicted to remain constant across Explanations – with both 'because' and full stop Explanations

4. Story continuation experiment

2 x 3 design: verb type (IC vs. Non-IC) x continuation type (full stop vs. *because* vs. dialog prompt – dialog results not discussed here)

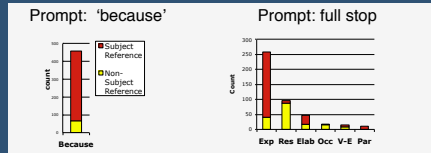
Task: construct natural continuation to context sentence and prompt

Materials: 40 IC verbs (20 IC-1, 20 IC-2) and 40 Non-IC verbs

Evaluation: judges annotated for next mention & coherence relation

6. IC-1 Results

Next-mention biases were statistically indistinguishable when only 'because' prompts and freely generated Explanations were considered ($F_1(1,70)=0.0221$, $p<0.8822$; $F_2(1,19)=0.032$, $p<0.86$)

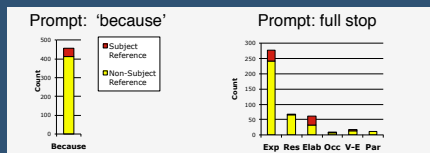


	Because	Exp	Res	Elab
P(Subject)	.85	.84	.10	.61

$$\rightarrow p(\text{next_mention} = \text{NP1} | \text{'because'}) \approx p(\text{next_mention} = \text{NP1} | \text{Explanation})$$

7. IC-2 Results

Again, next-mention biases statistically indistinguishable when only Explanations are considered ('because' or freely generated) ($F_1(1,73)=0.4424$, $p<0.5081$; $F_2(1,19)=1.2235$, $p<0.2825$)

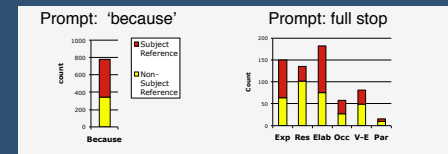


	Because	Exp	Res	Elab
P(Subject)	.13	.10	.03	.46

$$\rightarrow p(\text{next_mention} = \text{NP1} | \text{'because'}) \approx p(\text{next_mention} = \text{NP1} | \text{Explanation})$$

8. Non-IC Results

Again, next-mention biases statistically indistinguishable when only Explanations are considered ('because' or freely generated) ($F_1(1,61)<1$, $p<0.982$; $F_2(1,36)=1.4598$, $p<0.2348$)



	Because	Exp	Res	Elab	Occ	V-E
P(Subject)	.56	.57	.24	.58	.53	.40

$$\rightarrow p(\text{next_mention} = \text{NP1} | \text{'because'}) \approx p(\text{next_mention} = \text{NP1} | \text{Explanation})$$

9. A new IC bias

IC verbs create an expectation regarding the direction the discourse is likely to take – specifically a bias towards an upcoming Explanation

Findings for full-stop prompt:
IC verbs yield more Explanation continuations than do Non-IC verbs

10. Conclusions

Like Rohde et al.'s results, overall statistics conceal a consistent system of stronger biases once coherence relations are conditioned on.

In contrast to previous results:

- Connective alone does not affect referent salience – mediated by coherence
- There are actually two strong biases that differentiate IC and Non-IC verbs:
 $P(CR = \text{Explanation})$ is high for IC-1 and IC-2
 $P(\text{next_mention} = \text{NP1} | \text{Explanation})$ is high for IC-1 and low for IC-2

The presence of a second bias had gone unnoticed because previous studies had not categorized their data by coherence.

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